

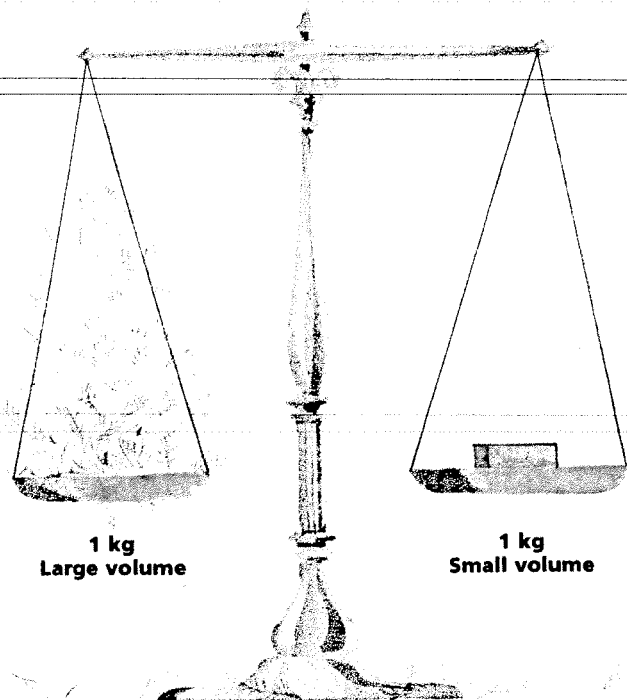
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What is density?

Objective ▶ Define density.

TechTerm

▶ **density** (DEN-suh-tee): mass per unit volume



Density Which do you think is heavier, a kilogram of feathers or a kilogram of lead? You may already know the answer to this riddle. They both weigh the same amount. However, a kilogram of feathers takes up a large amount of space, or volume. A kilogram of lead is small enough to hold in your hand. A kilogram of lead takes up less space because lead has a much greater **density** (DEN-suh-tee) than feathers. Density is the mass per unit volume of a substance. Substances that are very heavy for their volume are called dense (DENS) substances. A large mass of a dense substance fits into a small volume.

|||||▶ **Define:** What is density?

Units of Density You can find the density of a substance by finding the mass of a certain volume of the substance. Units of density include units of

mass and volume. Mass is measured in grams. The volume of solids is measured in cubic centimeters. The volume of liquids is measured in milliliters. One milliliter is equal to one cubic centimeter. Therefore, the density of any substance can be given in grams per cubic centimeter, or g/cm^3 . For example, water has a density of 1 g/cm^3 . There is 1 g of mass in 1 cm^3 of water. The densities of other common substances are listed in Table 1.

Table 1 Densities of Some Common Substances

SUBSTANCE	DENSITY (g/cm^3)
Air	0.0013
Alcohol	0.8
Aluminum	2.7
Cork	0.2
Gold	19.3
Iron	7.9
Lead	11.3
Mercury	13.6
Silver	10.5
Steel	7.8
Water	1.0

|||||▶ **Identify:** In what units is density measured?

Using Density Density is a basic physical property of all matter. Every substance has a density that can be measured. The density of a substance is always the same. The density of lead is always 11.3 g/cm^3 . The density of mercury is always 13.6 g/cm^3 . Density does not depend on the size or shape of the substance.

People can use density to help identify different kinds of matter. Suppose you have a metal and want to know what the metal is. You could identify the metal by finding its density. If the density is 10.5 g/cm^3 , the metal is silver. If the density is 2.7 g/cm^3 , the metal is aluminum.

|||||▶ **Identify:** What kind of property is density?

LESSON SUMMARY

- Density is the mass per unit volume of a substance.
- Density is measured in grams per cubic centimeter, or g/cm^3 .
- Density is a basic property of all matter.
- Density can be used to identify different substances.

CHECK Complete the following.

1. Density is the _____ per unit volume of a substance.
2. When a substance has a high density, a large mass fits into a _____ volume.
3. The units of _____ are grams per cubic centimeter.
4. Density is a physical _____ of all matter.
5. The density of a substance is always the _____.

APPLY Complete the following.

6. **Calculate:** What is the density of a metal block that has a mass of 750 g and a volume of 55 cm^3 ?

Use Table 1 on page 244 to answer the following questions.

7. a. What is the density of iron?
b. Of steel?
c. Of mercury?
8. How large a container would be needed to hold 800 g of water?
9. **Sequence:** List the following substances in order from lowest density to highest density: iron, gold, steel, water, air, silver, aluminum, gasoline.

Designing an Experiment.....

Design an experiment to solve the problem.

PROBLEM: What is the density of chalk?

Your experiment should:

1. List the materials you need.
2. Identify safety precautions that should be followed.
3. List a step-by-step procedure.
4. Describe how you would record your data.

SCIENCE CONNECTION

NEUTRON STARS AND BLACK HOLES

What are the densest objects known? The answer is neutron (NOO-trahn) stars and black holes. Here is how they form. A new star is made up of mostly hydrogen. As millions of years pass, the hydrogen fuses and changes into helium. When the hydrogen is used up, the star becomes a red giant.

A few red giants are at least eight times more massive than the sun. Such a massive star may blow up in a huge explosion called a supernova. After the explosion, some of the star's matter gets squeezed into a very dense object called a neutron star. The density of a neutron star is so great, it is hard to imagine. One cubic centimeter of matter in a neutron star would have a mass of 1,000,000,000,000,000 grams. Compare this to water. One cubic centimeter of water has a mass of 1 gram.

A very few red giants are 10 to 15 times more massive than the sun. Such a star eventually explodes and then collapses into a black hole. A black hole has a density even greater than that of a neutron star. The density of a black hole is thought to be infinite. Not even light escapes the strong pull of gravity in a black hole.

